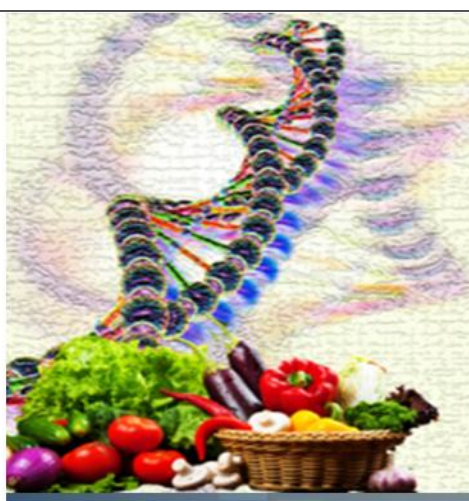




อาหารตามยีน NutriGenomics

ดร. กอบกุล สุดสวนตรี

CelFix Clinic and Lab

Diet And Genes

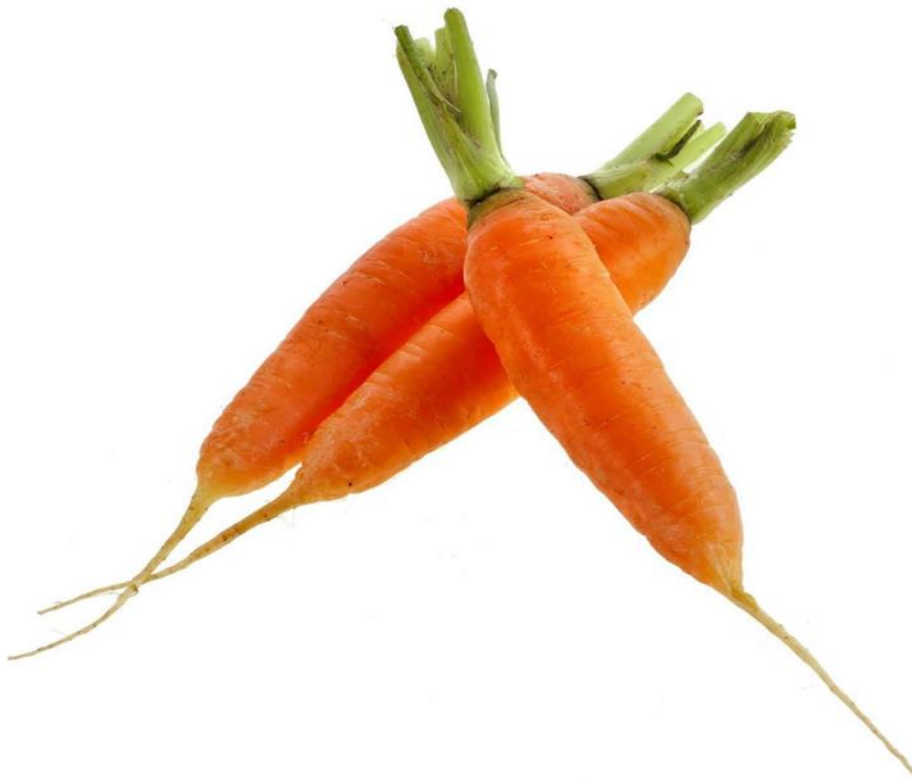


Newsweek. Jan. 17, 2005



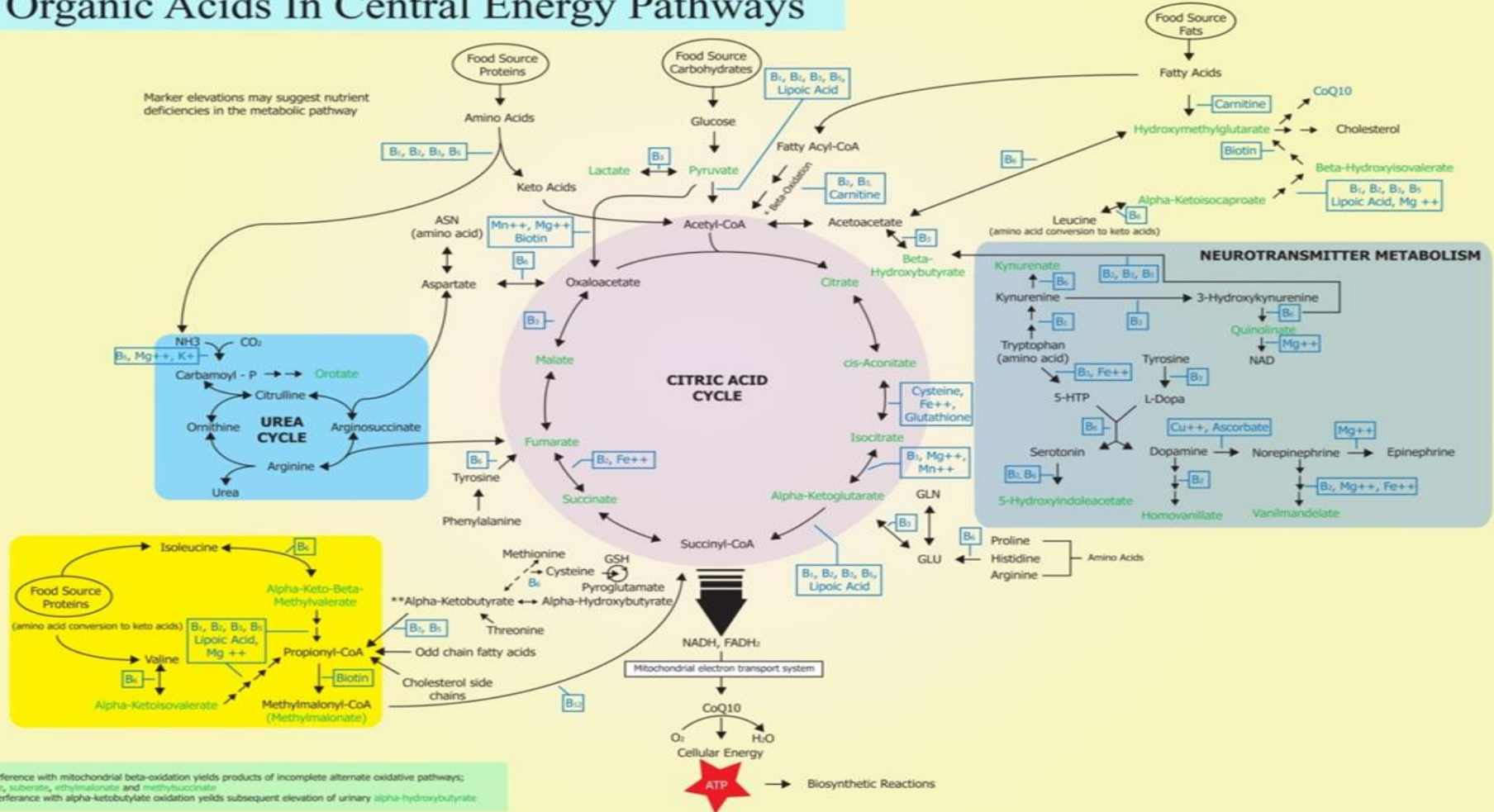
Food Is...

- Medicine
- Connection
- *Information*



Organic Acids In Central Energy Pathways

Marker elevations may suggest nutrient deficiencies in the metabolic pathway



THE LIVER DETOX PATHWAYS AND ESSENTIAL NUTRIENTS

Detoxification Pathways



Your genes are not your destiny

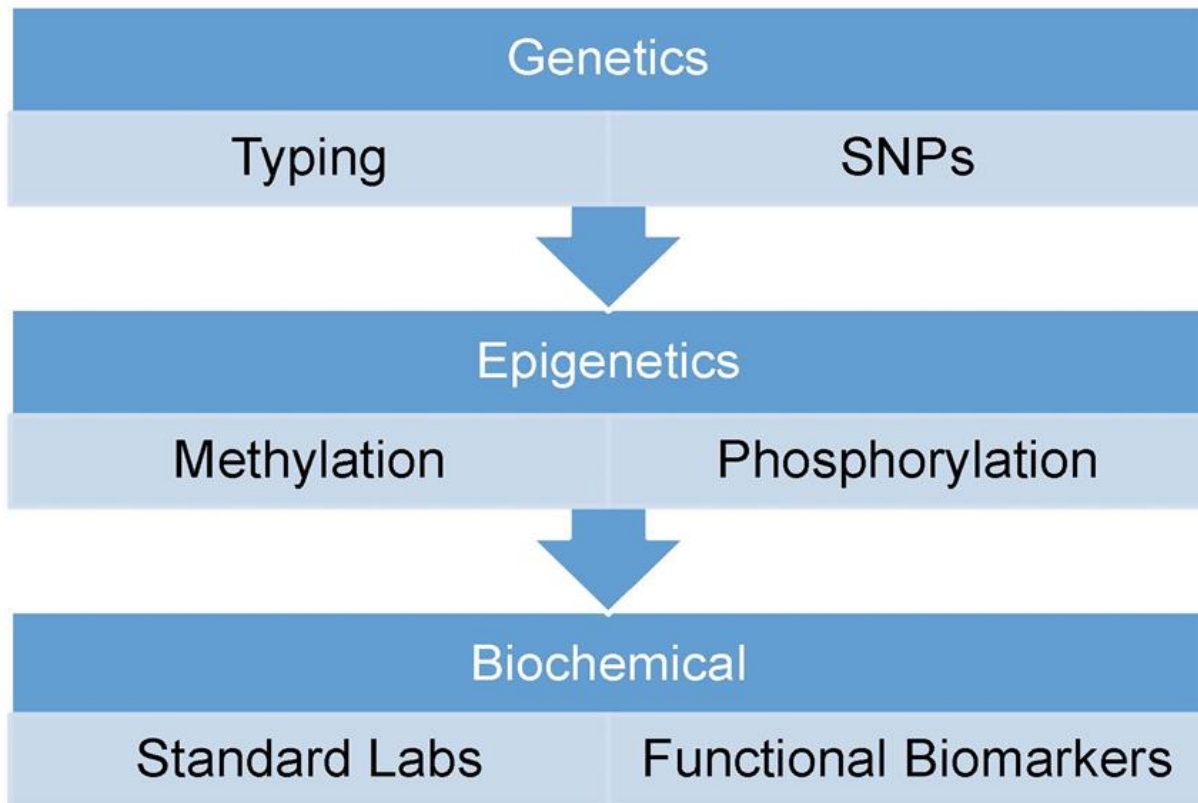
Although genes are critical for determining function, nutrition modifies the extent to which different genes are expressed and thereby modulates whether individuals attain the potential established by their genetic background.



Personalized Nutrition (Healthcare)

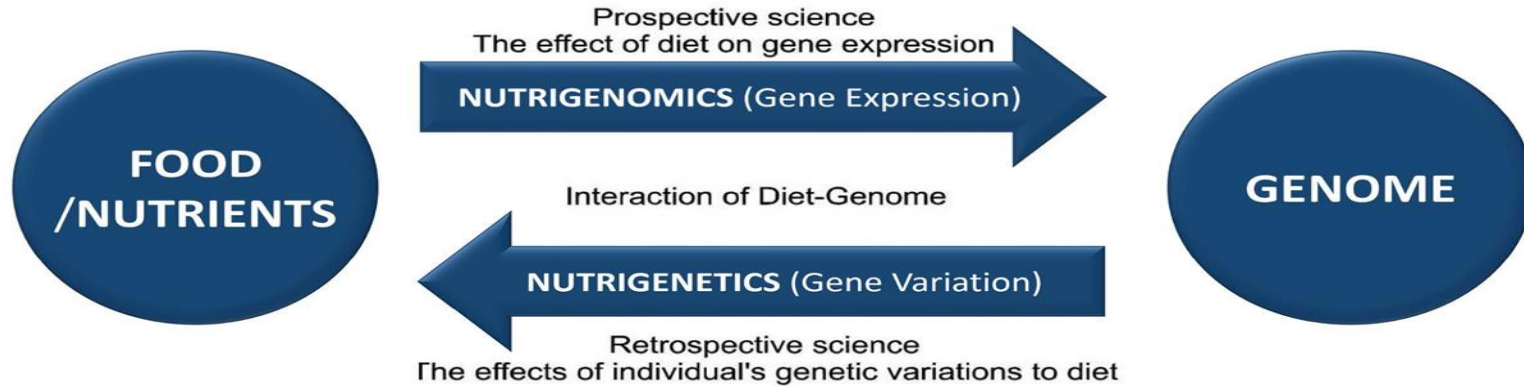
Targeted dietary prescriptions
for the individual based on
genetics and lifestyle

Levels of personalized, functional medicine-based health





Nutrigenomics: The Overview





Nutrigenomics

- The influence of food on genetic expression
- How what you eat turns on or off your genes
- Refers to the interaction between genes and nutrients
- Modification can occur directly or indirectly
- Chronic disease onset, incidence, progression, and/or severity influenced by diet-regulated genes and their common variants

Nutrigenomics

- Examples:
 - Sulforaphane in broccoli can turn off oncogenes (cancer-initiating or – causing genes)
 - Resveratrol in grape skin can lead to changes in gene expression that cause a shift in energy production and metabolism



Sulforaphane

Nutrition in Clinical Practice 20:75-87, February 2005



Foodomics



Foodomics is the comprehensive, high-throughput approach for the exploitation of food science in the light of an improvement of human nutrition

Foodomics is a new approach to food and nutrition that studies the food domain as a whole with the nutrition domain to reach the main objective, the optimization of human health and well-being



Phytoprofilng

The role of phytochemical modulation of cellular physiology and propose phytochemical profiling, or phytoprofilng, to assist in the facilitation of determining phytonutrient requirements with more effective interventions with plant-derived compounds





Nutrition & SNPs: Specific Profiles



Is Nutrition Important for Detox?

5 Potential Reasons Why Toxic Exposure Could Be a Health Issue for Some

1. Toxin dose and degree of exposure
2. Elimination
3. Deficiency or insufficiency of nutrients
4. Differences in genes for detox
5. Bacterial overgrowth in gut



All Phases of Detoxification Require Adequate Nutrients





Nutrition Protects **A**gainst **T**oxicity

- Sub-optimal or unhealthy nutrition modulates the toxicity of environmental contaminants
- Healthful nutrition decreases the toxicity of pro-inflammatory pollutants
- Healthful nutrition can decrease body burden of environmental contaminants

“We propose that positive lifestyle changes such as healthful nutrition and consumption of diets rich in fruits and vegetables or bioactive nutrients with antioxidant and/or anti-inflammatory properties will reduce the body’s vulnerability to environmental stressors and thus reduce toxicant-mediated disease pathologies.”



EGGS



SHELLFISH



MILK



FISH



CORN



WHEAT



PEANUTS



NUTS



SOY



SESAME



LUPINES



CELERY



MUSTARD



SUGAR



MEAT



SULFITES

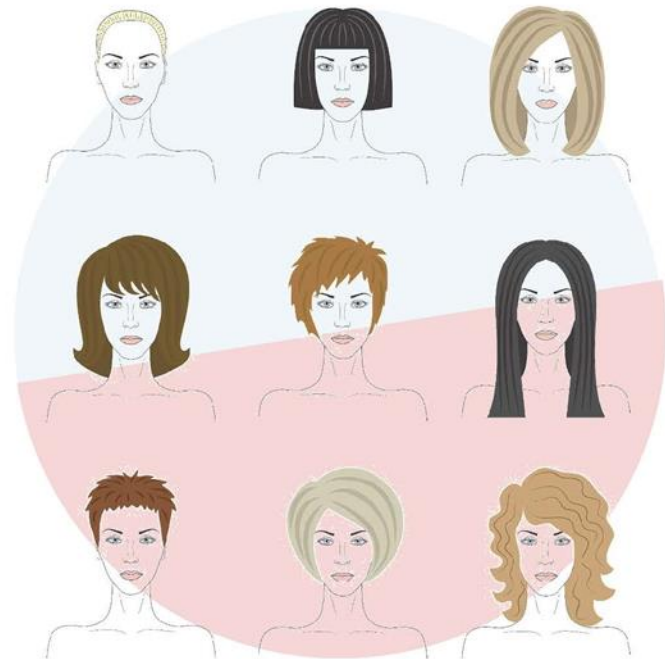
ARTIFICIAL
SWEETENERSARTIFICIAL
COLORTRANS
FATS

PRESERVATIVES

Reducing Toxin Load First and Foremost

It's What We Put in and Take out: *Elimination Diet + Nutrients*

“A statistically significant (47%) reduction in the Metabolic Screening Questionnaire scores resulted [*after 7 days of an elimination diet and a detox protein powder*]...” in 25 healthy women.





Powdered Detox Supplement Together with an Elimination Diet Reduces Symptoms of Fibromyalgia

Women with fibromyalgia on a 4-week program consisting of an elimination diet + phytonutrient-containing medical powder had reduced symptoms



What about Fasting/Juice Cleanses?



The Downside of Detox Diets

“The main health risks of detox diets relate to severe energy restriction and nutritional inadequacy. Extreme fasting can lead to protein and vitamin deficiencies, electrolyte imbalance, lactic acidosis and even death.”



Caloric Restriction and Toxicity

“Loss of body fat through caloric restriction mobilizes stored lipophilic xenobiotics and results in distribution to other tissues.”





Is There a Place for Fasting within Detox Protocols?

- Intermittent feeding
- Time-restricted feeding
- Periodic fasting
- Animal studies indicating improvements for diabetes, cardiovascular disease, cancers and neurological disorders such as Alzheimer's disease Parkinson's disease and stroke



Doing Fasting **C**orrectly

- Ensure hydration
- Eat nutrient-dense foods
- Monitor for dizziness, fatigue, energy loss



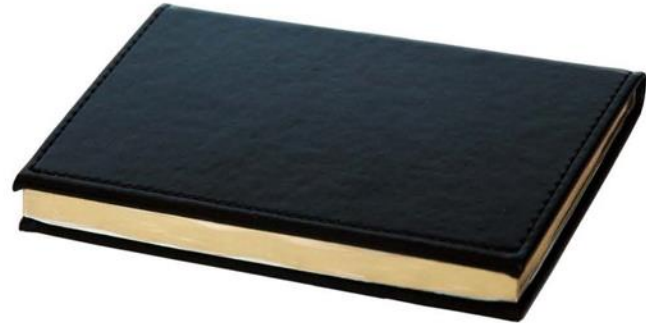


What Do You Do First?

Assess Diet and Lifestyle

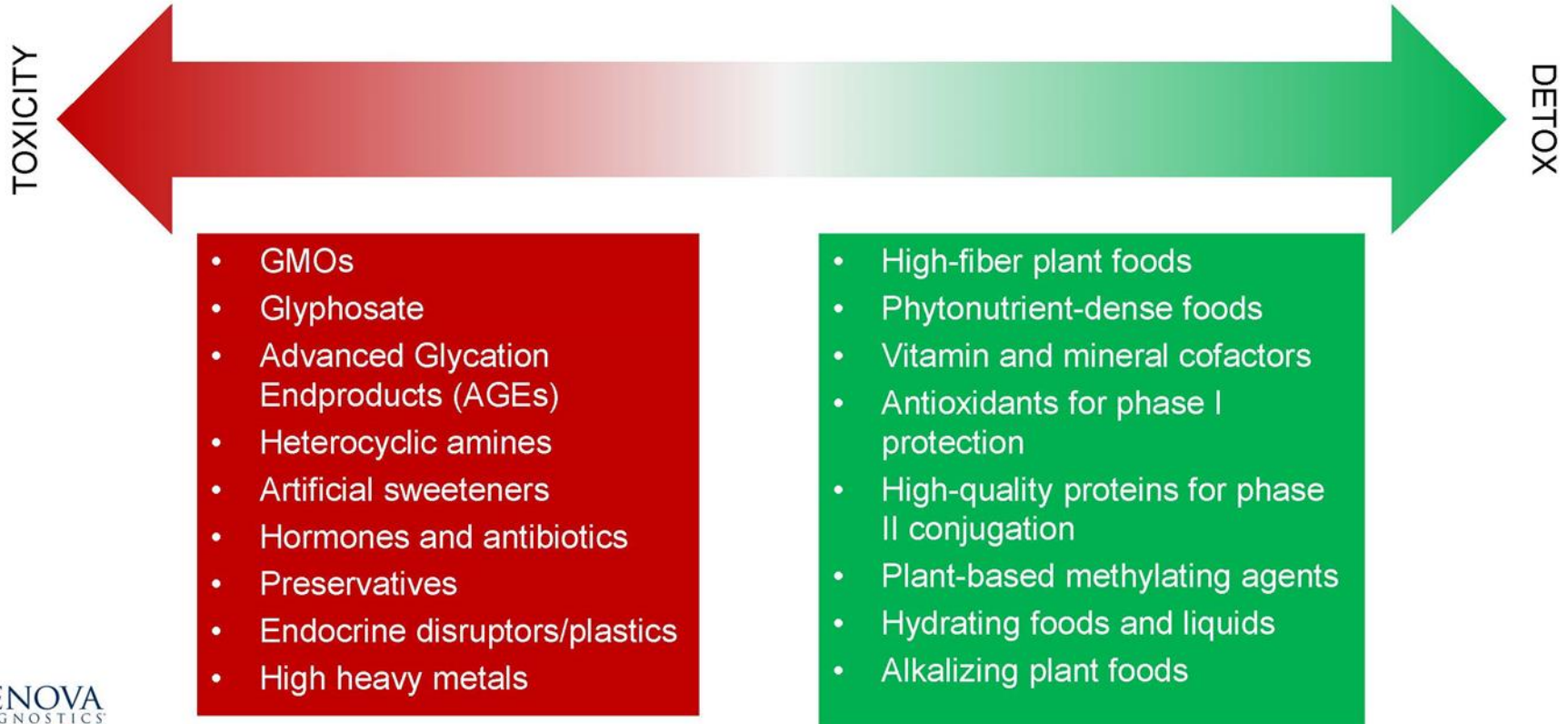
Use a diet and lifestyle journal to evaluate over multiple days:

- Food & drink intake, times
- Stress-reducing practices
- Sleep quantity and quality
- Exercise/movement
- Relationships
- Mental/emotional/spiritual health





Where Is Your Patient's Diet on the Spectrum?

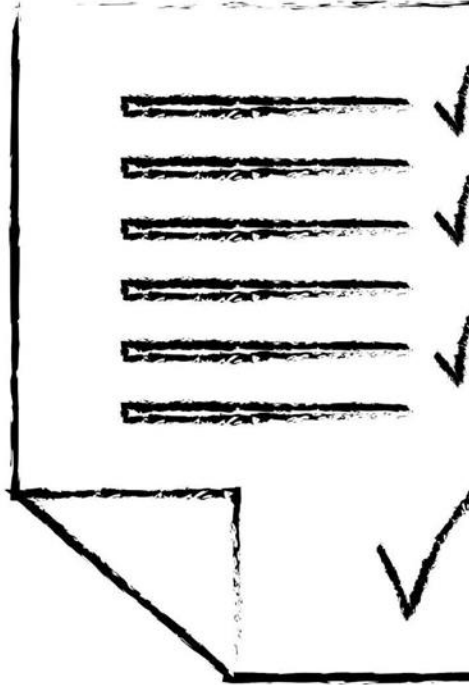




What is Toxic?

The Checklist

- ✓ Are they eating heavily processed foods with a number of synthetic ingredients?
- ✓ Are they eating refined oils?
- ✓ Are they eating high amounts of refined sugar?
- ✓ Do they eat artificial sweeteners?
- ✓ Are they eating large, regular amounts of high-mercury fish?
- ✓ Are they eating more conventional than organic foods?
- ✓ Are they drinking contaminated water?
- ✓ Are they eating the same things over and over again?
- ✓ Are they eating food in plastic or cans?
- ✓ Are they overcooking or browning foods?

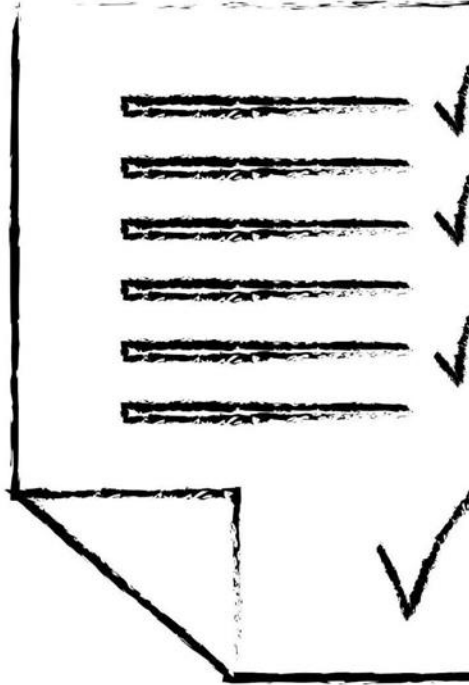




What is Detoxifying?

The Checklist

- ✓ They are eating organically grown fruits and vegetables
- ✓ They are eating varied colors of whole foods
- ✓ They are eating clean protein and fat sources
- ✓ They are drinking filtered water
- ✓ They are drinking from glass or stainless steel containers
- ✓ They are eating good quality protein sources throughout the day





Eat Organic:

Organic diets lower dietary exposure to organophosphorus pesticide in children

- N= 23 elementary school-age children
- Dietary organophosphorus pesticide exposure
- “We substituted most of children's conventional diets with organic food items for 5 consecutive days and collected two spot daily urine samples, first-morning and before-bedtime voids, throughout the 15-day study period.”
- “We found that the median urinary concentrations of the specific metabolites for malathion and chlorpyrifos decreased to the nondetect levels immediately after the introduction of organic diets and remained nondetectable until the conventional diets were reintroduced.”

Plants Are Essential to Human Health





What Do You Do with Food/Nutrients If Your Patient Has SNPs for CYPs?

กระบวนการล้างพิษของร่างกาย

สารพิษที่ละลายในไขมัน (เช่นยาที่ย่อยสลายไม่หมด ยาฆ่าแมลง สารเคมีต่าง ๆ ฮอร์โมน โลหะหนักต่าง ๆ)

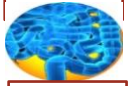
ผ่านเข้าร่างกายทาง



ปอด



ผิวหนัง



ลำไส้

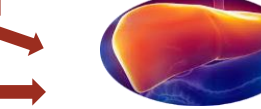
2 กระบวนการใหญ่ของการล้างพิษของร่างกาย

สารพิษที่ละลายในไขมัน

ยาที่ย่อยสลายไม่หมด
ยาฆ่าแมลง
สารเคมีต่าง ๆ
ฮอร์โมน
โลหะหนักต่าง ๆ

สารตัวกลางที่ยังมีฤทธิ์อยู่

Phase I
Reactive Intermediate
Phase II
ขับออก



ตับ

ของเสียที่ขจัดไม่ได้
จะเก็บสะสมใน

เซลล์ไขมัน
ไขกระดูก
ตับ
ระบบประสาท
ส่วนกลาง สมอง

ข้อต่างๆ
เลือด
เนื้อเยื่อต่างๆ
กล้ามเนื้อ

ผลข้างเคียง

สิว / ผื่นผิวหนัง, ภูมิแพ้, โรคข้ออักเสบ / ปวดข้อ, โรคภูมิต้านทานเป็นพิษ, โรคหัวใจและหลอดเลือด, โรคอ่อนเพลียเรื้อรัง, ท้องผูก, โรคเบาหวาน, โรคท้องร่วง, โรคปวดกล้ามเนื้อ, ปวดหัว, ความไม่สมดุลของฮอร์โมน, โรคลำไส้อักเสบเรื้อรัง, ความผิดปกติของระบบประสาท, โรคอ้วน / น้ำหนักเกิน

สารพิษที่ละลายในน้ำ

จะขจัดออกทาง



ผิวหนัง



ไต



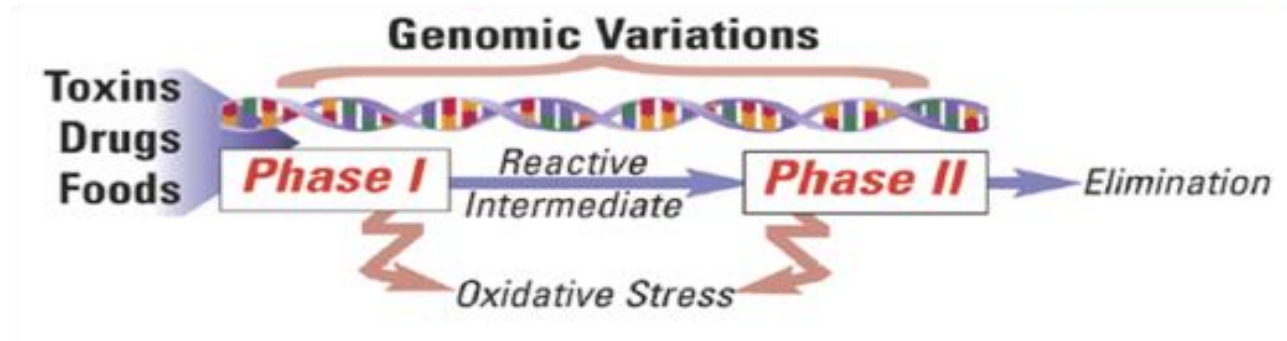
ลำไส้ใหญ่



ปอด

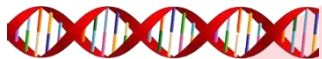


Two Major Pathways of Detoxification



DetoxiGenomic® Profile (การล้างสารพิษของร่างกาย)

DetoxiGenomic® Profile เป็นการตรวจ genes ที่ควบคุม enzymes ของระบบ การล้างพิษของร่างกายโดย เอ็นไซม์พวกนี้ทำปฏิกิริยาเปลี่ยนสารที่เป็นพิษ (active toxins) พวก ยา อาหาร และ สารพิษที่ได้จาก สิ่งแวดล้อม เป็นสารไม่เป็นพิษ (non-active toxins) ให้ละลายน้ำได้ดีขึ้นและสามารถขับถ่ายออกจากร่างกายทางไตและลำไส้ การล้างพิษ (detoxification) แบ่งเป็น 2 ขั้นตอน



Genomic Variation

Phase I

เป็น ขั้นตอนแรกของการ ล้างพิษของร่างกายในตับ เป็นการขจัดของเสีย โดยใช้ เอ็นไซม์ กลุ่มcytochrome P-450, ซึ่งใช้ออกซิเจน ในการ เปลี่ยน ของเสีย พวก ยา สอร์โม่ และของเสียต่างๆจากสิ่งแวดล้อม และอาหาร เป็นสารที่ละลายน้ำได้ง่ายขึ้น และสามารถขจัดออกจากร่างกาย

เอ็นไซม์ล้างพิษ phase 1 (Detoxification Enzymes)

- CYP1A1 • CYP2A6
- CYP2C9 • CYP3A4
- CYP1B1 • CYP2D6
- CYP2C19



Oxidative stress

Phase II—การ ล้างพิษ สารที่มีขนาดใหญ่และละลายน้ำได้ดี เช่น methyl. Acetyl mercaptan etc.. จะถูกเติมเข้าไปในสารพิษที่ OH group จากปฏิกิริยา เฟส 1 หลังจากการเติมสารนี้ ร่างกายจะสามารถกำจัด ของเสียได้ทางเหงื่อ ปัสสาวะ และอุจจาระ

- **Methylation**- (catechol-O-methyltransferase)- COMT-สลายพิษตกค้างของสารสื่อประสาท ที่มี Catechol เป็นองค์ประกอบ (Catechol Neurotransmitters) SNPs ทำให้เอ็นไซม์ทำงานช้าลง (slow metabolism) อาจทำให้เกิดการคั่งของสารสื่อประสาท เกิดเป็นอาการผิดปกติทางจิตใจ (Psychic Disorder) เช่น อาการเครียด โรควัว (panic disorder) โรค Bipolar ADHD (attention deficit hyperactive disorder)

-**Acetylation** (N-acetyl transferase NAT1, NAT2, -NAT detoxifies many environmental toxins, including tobacco smoke and exhaust fumes.

Polymorphisms may result in slow or rapid acetylation-increased risk of lung, colon, bladder, or head & neck cancer.

Glutathione Conjugation (glutathione s-transferase) • GSTM1 • GSTT1 • GSTP1

GST detoxifies many water-soluble environmental toxins, including solvents, herbicides, fungicides, and heavy metals (eg, mercury, cadmium, and lead). Defects in GST activity can contribute to fatigue syndromes and many cancers.



สารพิษ
ที่
ละลาย
ในน้ำ

สารพิษที่ละลาย
ในไขมัน (เช่น
ยาที่ย่อยสลายไม่
หมด ยาฆ่าแมลง
สารเคมีต่าง ๆ
สอร์โม่ โลหะ
หนักต่าง ๆ)
....

การป้องกันอนุมูลอิสระ superoxide dismutase)

• SOD1 • SOD2

Mutations affecting these antioxidant enzymes can lead to increased free radical activity and cell damage, and may increase the risk of developing neurodegenerative disorders)





GENOVATIONS™

63 Zillicoa Street
Asheville, NC 28801
© Genova Diagnostics

Patient: [REDACTED]

DOB: [REDACTED]

Sex: F

MRN: [REDACTED]

Order Number: [REDACTED]

Security Code: [REDACTED]

PHASE I Detoxification: The First Line of Defense

In Phase I detoxification, enzymes, known collectively as the cytochrome P-450 system, use oxygen to modify toxic compounds, drugs, or steroid hormones. Many toxins must undergo Phase II detoxification after a reactive site has been formed. Because there are many different toxic compounds the body might encounter, there are many variants of Phase I enzymes.

Cytochrome P-450	
Result	Gene
✓	CYP1A1 *
●	CYP1B1 *
✓	CYP2A6
●	CYP2C9 *
✓	CYP2C19 *
✓	CYP2D6
✓	CYP3A4 *

Your Results: Polymorphisms (SNPs) in the genes coding for a particular enzyme can increase or, more commonly, decrease the activity of that enzyme. Both increased and decreased activity may be harmful. Increased Phase I clearance without increased clearance in Phase II can lead to the formation of toxic intermediates that may be more toxic than the original toxin. Decreased Phase I clearance will cause toxic accumulation in the body. Adverse reactions to drugs are often due to a decreased capacity for clearing them from the system.

Key

✓ Optimal genomic potential - no polymorphism detected

● Polymorphism detected in this enzyme, increasing your susceptibility to toxins, if exposed

* Multiple SNP locations were evaluated for these genes

NR See commentary if applicable



SNPs in Thai Population 100 subjects (Detoxigenomic)

	SNP	Health Implication
Phase 1		
CYP1A1 *	84%	Detoxifies poly- cyclic aromatic hydrocarbons (PAHs) produced from the combustion of organic materials (exhaust fumes, charbroiled meats, etc.).
CYP1B1 *	15%	is involved in the 4-hydroxylation of estrogen
CYP2A6	0%	detoxifies nitrosamines and nicotine
CYP2C9 *	7%	detoxifies coumadin® and sulfonylureas.
CYP2C19 *	25%	detoxifies proton-pump inhibitors (e.g., priobsec®) and many anticonvulsants (e.g., valium®).
CYP2D6	0%	detoxifies ~20% of all prescription drugs including tricyclics, MAOIs, SSRIs, opiates, anti-arrhythmics, beta- blockers, Cimetidine, etc
CYP3A4	0%	detoxifies over 50% of all prescription medications and most steroid hormones

SNPs in Thai Population 100 subjects (Detoxigenomic)

Phase 2

Gene	Affects	SNP	Health Implication
Methylation			
COMT	Liver/Gut	39%	Polymorphisms may lead to impaired metabolism of the catecholamine neurotransmitters (dopamine, epinephrine, and norepinephrine) and may predispose individuals to anxiety , ADHD, alcoholism, and rapid cycling in bipolar individuals.

Acetylation (N-Acetyltransferase)-

Slow Metabolizer Polymorphism

NAT1	All cells	0%	NAT detoxifies many environmental toxins, including tobacco smoke and exhaust fumes. Polymorphisms may result in slow or rapid acetylation, both associated with increased risk of lung, colon, bladder , or head & neck cancer .
NAT1	Liver/Gut	0%	
NAT2	Liver/Gut	26%	
NAT2	Liver/Gut	55%	
NAT2	Liver/Gut	30%	
NAT2	Liver/Gut	0%	

Fast Metabolizer Polymorphism

NAT2	Liver/Gut	22%
------	-----------	------------

absence

Glutathione Conjugation (Glutathione s-transferase)

GSTM1	Liver/Kidney	74%	GST detoxifies many water-soluble environmental toxins, including solvents, herbicides, fungicides, and heavy metals (eg, mercury , cadmium, and lead). Defects in GST activity can contribute to fatigue syndromes and many cancers
GSTP1	Brain/Skin	36%	
GSTP1	Brain/Skin	4%	

Oxidative Protection

SOD1	Cytosol	0%	Mutations affecting these antioxidant enzymes can lead to increased free radical activity and cell damage, and may increase the risk of developing neurodegenerative disorders
SOD1	Cytosol	0%	
SOD2	Mitochondria	100%	



Tailoring Foods to Detox Pathways

- Phase I Cytochrome Systems
- Phase II Conjugation Enzymes
- Antioxidant Response Element/Nrf2
- Metallothionein Response Element



7 Things to Know about SNPs When It Comes to Detox

- Strong research and clinical data are lacking
- SNPs go together with functional biomarkers for a complete biochemical picture
- SNPs are a qualitative rather than a quantitative marker
- They cannot be judged in isolation
- Epigenetics is often not taken into account when discussing genetic variants
- SNPs are typically not “on” or “off”
- Clinical symptoms should be main driver to treat rather than SNPs, although SNPs may provide insight on what to address



What If You Have Patients with SNPs in the Cytochrome P450s (CYPs)?

Fortify Using Basic Nutritional Cofactors

“Thus, 5-fold reducing of vitamin content in rat diet lead to significant changes in activity and inducibility of cytochrome P450 of CYP1A and 3A family, which play a key role in the detoxification and metabolism of drugs.”

Vopr Pitan. 2014;83(3):4-11.

The study has demonstrated that profound multi-vitamin deficiency is associated with a decrease in the expression of CYP1A2 and CYP3A1 mRNAs to 62 % and 79 %, respectively. These data indicated that a short-term but profound multi-vitamin deficiency in rats leads to a decrease in the activities and expression of the some XME that play an important role in detoxification of xenobiotics and metabolism of drugs and antioxidant protection.

Int J Vitam Nutr Res. 2013;83(1):5-13.

- Nutrient-dense foods
- Daily full-spectrum MVM



Provide Antioxidant Support to Those Patients Going through Toxic Stresses

Broad-spectrum antioxidants:

- Vitamin C and bioflavonoids
- Vitamin E and tocotrienols
- Mixed carotenoids

For patients who:

- Have SNPs in Phase II enzymes
- Have toxic jobs and hobbies
- Are under undue stress



Fish oil
Lycopene
Curcumin
Cruciferous vegetables
Garlic
Catechins
Resveratrol
Ginger
Purple sweet potato
Isoflavones
Coffee
Rosemary
Blueberry
Pomegranate
Naringenin
Ellagic acid
Astaxanthin
Gamma-tocopherol

Examples of Food and Food Bioactive INDUCERS of ARE Enzymes

Hodges RE, Minich DM. Modulation of Metabolic Detoxification
Pathways Using Foods and Food-Derived Components: A Scientific
Review with Clinical Application. J Nutr Metab. 2015;2015:760689.
doi: 10.1155/2015/760689. Epub 2015 Jun 16.

ARE = Antioxidant Respond Element
XRE = Xenobiotic Respond Element

Fermented Foods May Activate Nrf2 Due to the Presence of Alkyl Catechols

Senger DR, Li D, Jaminet SC, Cao S. (2016) Activation of the Nrf2 Cell Defense Pathway by Ancient Foods: Disease Prevention by Important Molecules and Microbes Lost from the Modern Western Diet. PLoS One. 2016 Feb 17;11(2):e0148042. doi: 10.1371/journal.pone.0148042. eCollection 2016.



Nrf2 is a basic leucine zipper (bZIP) protein that regulates the expression of antioxidant proteins that protect against oxidative damage triggered by injury and inflammation. Several drugs that stimulate the NFE2L2 pathway are being studied for treatment of diseases that are caused by oxidative stress.



Vitamin E and C Supplementation for Daily Job Toxin-Exposure

- Antioxidants (vitamin E 400 IU + vitamin C 1 g/day) supplemented for 1 year to 15 workers exposed to Pb compared with non-Pb exposed workers
- Pb intoxication = high oxidative damage
- Antioxidant supplementation decreased the oxidative damage



The Benefits of Beta-carotene Supplementation in Lead-Exposed Workers

- N=33 healthy male workers exposed to Pb
- N=49 control group
- Supplemented with beta-carotene at 10 mg/day/12 weeks
- MDA significantly decreased in supplemented group, compared to baseline, by 16%, and to the reference group
- When compared to the reference group, Hcy level was also significantly decreased
- The level of thiol groups was significantly higher after supplementation with beta-carotene compared to the reference group



What Do You Do with Food/Nutrients If Your Patient Has SNPs for Phase II Detox Enzymes?



What If You Have Patients with Multiple SNPs in the Phase II Enzymes?

Focus on amino acids/protein:

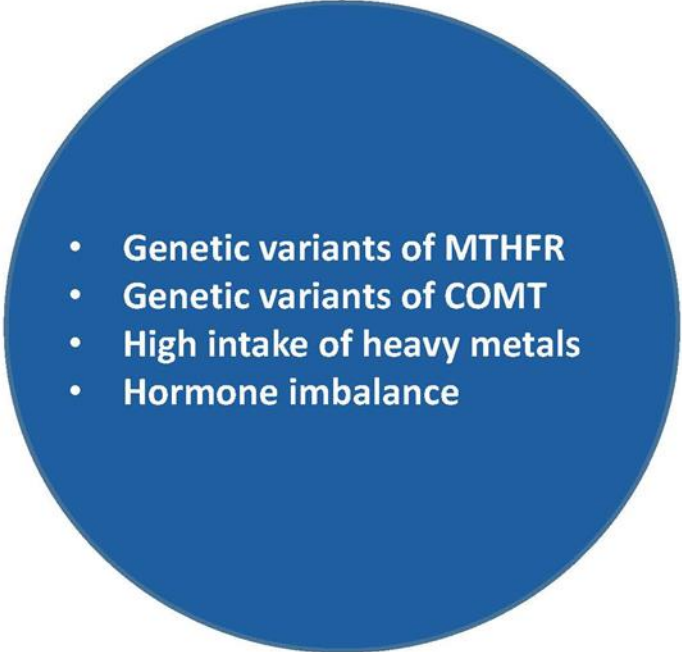
- Arginine
- Glutamine
- Glycine
- Methionine
- Ornithine
- Taurine

Be sure that patients are properly digesting their protein with betaine HCl and proteases



What If You Have Patients Who Need Support for Methylation?

- COMT
- MTHFR (C677T, A1298G)
- Use functional biomarkers to support whether there is a need
- Evaluate symptoms
- Note that there are many methylation-related SNPs

- 
- Genetic variants of MTHFR
 - Genetic variants of COMT
 - High intake of heavy metals
 - Hormone imbalance



Methylation/MTHFR & COMT:

Dietary Strategies

- High intake of folate-rich green vegetables
- Mediterranean diet may help to lower Hcy
- Ensure adequate intake of vitamins B2, B6, B12, and 5-MTHF, but not supraphysiological levels
- Betaine can help regenerate methionine from Hcy
- Avoid excessive coffee intake
- Avoid high alcohol intake



What If You Have Patients Who Need Support for Glutathione Conjugation (GSTs)?

- Function is to add a glutathione group to a biotransformed metabolite
- Can be induced through ARE and XRE
- GST SNPs
- Check GGT activity

ARE = Antioxidant Respond Element
XRE = Xenobiotic Respond Element

**Patients with liver
damage, alcohol
abuse, oxidative stress**



What If You Have Patients Who Need Support for Glutathione Conjugation (GSTs)?

Nutrient Inducers:

- **Cruciferous vegetables, 5-10 servings/day**
- **Allium vegetables (chives, leeks, garlic, onion)**
- **Resveratrol**
- Citrus
- Garlic oil
- Fish oil
- Anthocyanin extract from purple sweet potato
- Curcumin
- Green tea (4 cups/day)
- Rooibos tea
- Honeybush tea
- Ellagic acid
- Carnosic acid
- Ghee
- Genistein



**Patients with liver
damage, alcohol
abuse, oxidative stress**



What If You Have Patients Who Need Support for Glutathione Conjugation (GSTs)?

Nutrient Inhibitors:

- **Apiaceous vegetables**
(dill, celery, parsley, parsnips, carrots)
- Quercetin
- Genistein

**Patients with liver
damage, alcohol
abuse, oxidative stress**



What If You Have Patients Who Need Support for Glucuronidation (UGTs)?

When to be thinking about it:

- 40-70% of all medications subject to glucuronidation
- UGTs metabolize phytochemicals
- Lack of proper bile flow
- Dysbiosis: look for elevated levels of beta-glucuronidase

Patients taking medications, lack of proper bile flow, dysbiosis, hormone imbalance



What If You Have Patients Who Need Support for Glucuronidation (UGTs)?

Nutrient Inducers

- **Cruciferous vegetables, 5-10 servings/day**
- **Resveratrol (only in those with low activity)**
- **Citrus fruits (1/2 serving or more/day for a specific SNP 1A1*28)**
- Dandelion tea
- Rooibos tea
- Honeybush tea
- Rosemary extract
- Soy extract
- Ellagic acid
- Ferulic acid
- Curcumin
- Astaxanthin
- D-glucaric acid

Patients taking medications, lack of proper bile flow, dysbiosis



D-Glucaric Acid Content in Plant Foods

Food	Amount (g/kg)
Grapefruit	3.60
Apple (Macintosh)	3.45
Alfalfa sprouts	3.45
Broccoli	3.40
Apple (Granny Smith)	3.36
Adzuki bean sprouts	2.78
Brussels sprouts	2.67
Apple (Red Delicious)	2.26
Tomato	2.09
Cauliflower	1.79
Mung bean sprouts	1.46

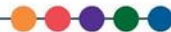


What Do You Do with Food/Nutrients If Your Patient Has Irregular Elimination of Toxins?



Ensure Proper Elimination and Gut Health

- Adequate fiber – 30 to 50 grams daily
- Adequate water
- Fermented foods
- Whole, plant-based foods
- Probiotics



Certain Probiotics Help to Eliminate Toxins

“Consumption of probiotic yogurt had a protective effect against further increases in mercury and arsenic blood levels in the pregnant women...

Elevated blood lead was associated with increases in Succinivibrionaceae and Gammaproteobacteria relative abundance levels in stool.”



Prevent Resorption of Estrogen With Fiber

“Serum oestrone sulphate fell with wheat bran (mean intake 19.8 g day⁻¹) and with senna;”

“In conclusion, speeding up intestinal transit can lower serum oestrogen concentrations.”

- Water intake essential
- Vitamin C and Mg can also reduce constipation



How Can I Use Nutrition to Support Patients Exposed to Heavy Metals?



Dietary Sources of Heavy Metal Chelators

- Fibers, notably insoluble fibers rather than soluble fibers
- Modified citrus pectin
- Chlorella
- Sulfur-containing foods like garlic
- Cilantro (mixed results)
- Coriander
- Green tea EGCG
- Quercetin
- Turmeric/curcumin
- Matcha
- Green vegetables/chlorophyll



High-Sulfur Diet Helps to Reduce Damage from Toxic Metals

- “Given that toxic metals have great affinity for sulphur-containing peptides, diets rich in sulphur-containing foods such as alliums (e.g. garlic) and brassicas (e.g., broccoli) have been suggested for effects on glutathione, with hopes for symptomatic improvement and enhanced excretion.
- Garlic prevented cadmium-induced kidney damage and decreased the oxidative damage due to lead in rats.”

Fiber Binds Metals:

Aim for a Variety

- Mainly *in vitro* studies: alginic acid ↑ Pb; pectin, agar, and carrageenan ↑ Cd
- Wheat bran binds Hg, Cd, Pb
- Encourage variety to prevent intolerance
- Aim for 35 grams in daily diet
- Use supplement if needed
- Ensure water intake





A Detox Dietary Oil: Sesame Oil for Heavy Metal Toxicity

- “Sesame oil (a natural edible oil) and sesamol (an active antioxidant) are potentially beneficial for treating lead- and iron-induced hepatic and renal toxicity and have no adverse effects.”
- “...sesame oil is a potent inhibitor of proinflammatory mediators, and it attenuates lead-induced hepatic damage by inhibiting nitric oxide, tumor necrosis factor- α , and interleukin-1 β levels.”



Spirulina for Heavy Metal Detox

Spirulina has beneficially counteracted toxic effects from exposure to arsenic, cadmium, carbon tetrachloride, deltamethrin, fluoride, hexachlorocyclohexane, iron, lead, lindane, and mercury

“Spirulina could be a useful coadjuvant agent within clinical practice for treatment of these or other pollutants poisonings.”



“Riceabetes”

Postgrad Med. 2015;127(8):781-2.



“Riceabetes”

- “A high intake of rice is associated with a high incidence and prevalence of diabetes
- While this may be partially due to the high glycemic index carbohydrate content, it may also be due to a high arsenic level found in rice
- Arsenic increases insulin resistance and decreases beta-cell function through oxidative stress, high cytokine levels, activation of NF-kappa B and increased amyloid formation in the pancreatic beta cells.”



Folic Acid to Lower Blood Arsenic: A Randomized Controlled Trial

- We conducted a clinical trial in which 622 participants were randomized to receive 400 µg FA, 800 µg FA, 3 g creatine, 3 g creatine+400 µg FA, or placebo daily
- In this mixed folate-deficient/replete study population, 12- and 24-week treatment with 800 µg (but not 400 µg) FA lowered bAs to a greater extent than placebo; this was sustained 12 weeks after FA cessation

Curcumin as a Heavy Metal Binder

- Rat study, brain section analyzed for metals
- 30 mg/kg curcumin
- “These results imply that curcumin could be used therapeutically to chelate these toxic metals, thus potentially reducing their neurotoxicity and tissue damage.”



Toxins in Spices and Herbs

- “A total of 300 samples representing six condiments (black pepper, basil, oregano, nutmeg, paprika, and thyme) were analysed for 11 mycotoxins, 134 pesticides, and 4 heavy metals
- Mycotoxins were detected in 4%, 10%, and 30% of all nutmeg, basil, and thyme samples, respectively
- The residues of 24 pesticides were detected in 59% of the analysed condiments. The maximum residue levels of pesticides were exceeded in 10% of oregano and 46% of thyme samples.”





Cilantro Soup for Mercury Detox:

Female Dentist with Chronic Fatigue

- 54 yo female dentist with elevated Hg in hair and chronic fatigue
- Reports minimal fish consumption
- Contamination through occupational exposure
- Patient recommended to consume coriander soup, 50 g of washed and fresh coriander (cilantro) in boiling water for 15 min for at least 3 times per week
- Instead, she ate raw as salad
- After 6 months, retest for Hg, and no improvement
- Began consuming cooked in form of soup
- Retest at 12 months showed an 86% reduction in Hg



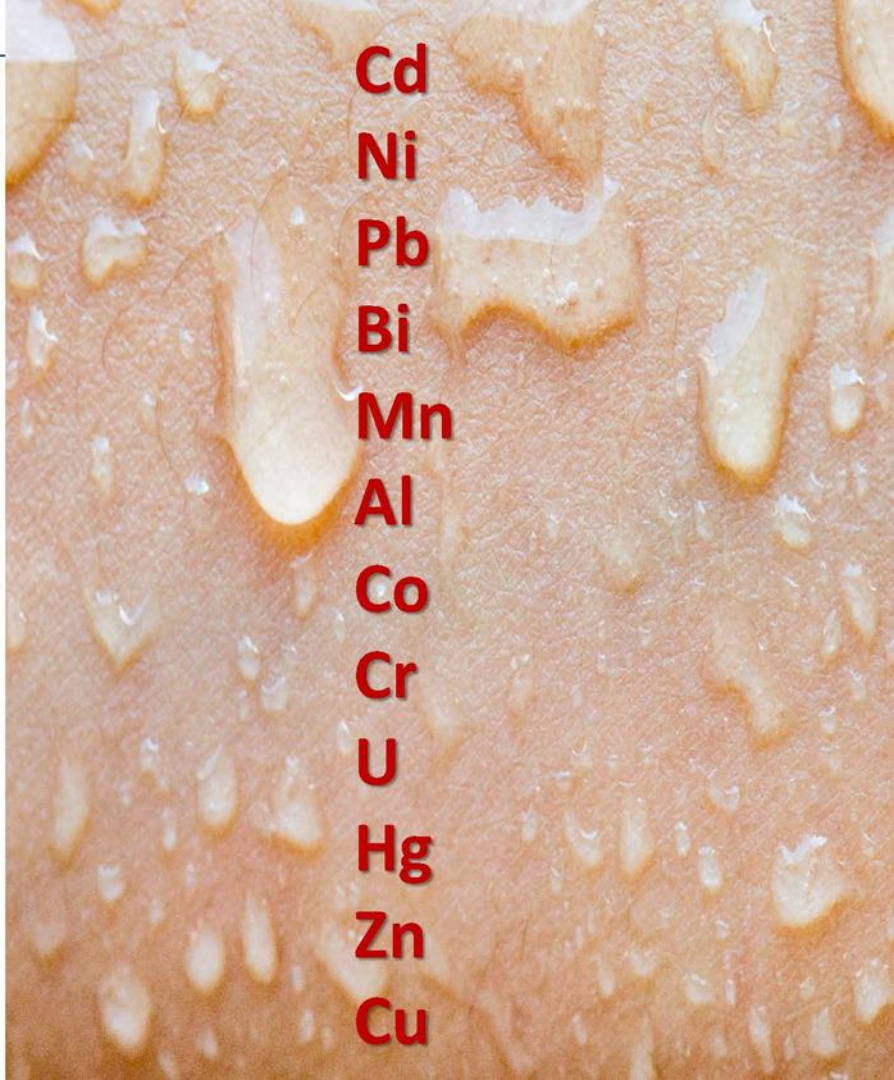
Sweating Reduces Metal Burden

Replenish with Mineral-Rich Foods

- Blood, urine, and sweat were collected from 20 individuals (10 healthy participants and 10 participants with various health problems) and analyzed for approximately 120 various compounds, including toxic elements
- Many toxic elements appeared to be preferentially excreted through sweat
- Induced sweating appears to be a potential method for elimination of many toxic elements from the human body

Sweating Leads to Excretion of Metals

Metals which were released more extensively in sweat compared with urine



Cd
Ni
Pb
Bi
Mn
Al
Co
Cr
U
Hg
Zn
Cu



Upregulation of Heavy Metal Excretion through Minerals

- Metallothionein as a cysteine-rich protein that sequesters metals and minerals
- In absence of heavy metals, primary role is to transport Zn and Cu
- Known to efficiently bind several toxic metals (particularly Cd and Hg) and act as transporter of toxic metals to the liver or kidneys for conjugation and excretion
- Prevents reaction of toxic metals with other biomolecules, thus attenuating their toxicity
- Inducible



Zinc Supplementation for Increasing Metallothionein

- 15 mg of Zn per day to human subjects
- “...increased MT mRNA abundance by up to 2-fold in RNA from leukocyte subsets”



How Can I use Nutrition to Support Patients Exposed to Persistent Pollutants?



Look to Dietary History

- Do you see more conventional rather than organic produce?
- Has the patient recently lost weight or yo-yo dieted throughout their lives?
- Look for these foods:
 - Non-organic butter (high in DDE, HCB)
 - Farmed Atlantic salmon and some lake-caught fish (DDE, dieldrin, HCB, mirex)
 - Non-organic greens, e.g., spinach, collards (DDE)
 - Non-organic cheeses, e.g., cream cheese, cheddar, American (DDE, dieldrin, HCB)
 - Non-organic fatty meats, e.g., lamb, ground beef (DDE, HCB)



Higher POPs with Greater Weight Loss



POPs =
Persistent
Organic
Pollutants

Serum concentrations of most POPs were higher in those with long-term weight loss, whereas they were lower in those with long-term weight gain



Gastric Bypass-Increased Plasma

- Plasma organochlorine concentration increased with weight loss and was related to magnitude of weight loss
- After surgery, 388.2% increase after 1 year



Organic Meat Isn't Free of POPs

- 76 samples of meat (beef, chicken, lamb)
- Organic and conventional
- 33 carcinogenic POPs assessed

“As expected, no sample was completely free of carcinogenic contaminants, and the differences between organically and conventionally produced meats were minimal.”



Reducing Pesticides of Fruits

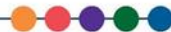
- Washing with tap water, boiling, and sun drying reduced pesticides
- Peeling and juicing reduced pesticide residues only slightly
- Oven drying led to an increase in pesticides



Don't Forget Spirulina

Spirulina has beneficially counteracted toxic effects from exposure to arsenic, cadmium, carbon tetrachloride, deltamethrin, fluoride, hexachlorocyclohexane, iron, lead, lindane, and mercury

“Spirulina could be a useful coadjuvant agent within clinical practice for treatment of these or other pollutants poisonings.”



Vitamin C for POP Decreases

- 15 healthy women
- 2 months of vitamin C supplementation (1000 mg/day)
- Statistically significant decreases in 6 PCBs and 2 OCPs

“...vitamin C intervention may have important public health implications in protecting health by reducing body burdens of POPs.”



Chlorella Decreases Dioxin in Breast Milk:

Ensure a Safe Detox

- Dioxin high in breast milk
- Measured dioxin levels in breast milk and maternal blood from 35 pregnant women in Japan
- 18 of the 35 took chlorella supplements during pregnancy
- “Toxic equivalents were significantly lower in the breast milk of women taking chlorella tablets than in the control group.”
- May increase IgA levels in breast milk



Rice Bran Fiber Binds Polychlorinated Compounds and Carcinogens

- Binding of rice bran fiber to PCBs, PCDFs, and PCDDs was greater than other dietary fibers, including corn, wheat bran, spinach, Hijiki, sweet potatoes, and burdock fibers
- Binding appears to be related to the lignin contents
- RBF capable of binding even conjugates containing mutagens such as glucuronides and sulfates, as well as metabolites in urine
- Suggested in Japan for those who suffered food poisoning due to rice oil contamination

Organic Honey Reverses Pesticide-Induced Genotoxicity

“In the present study, we evaluated the extracts from four organic honey varieties (acacia, chestnut, orange tree, woodland) for their polyphenol composition, antioxidant effects and effect on toxicity induced by pesticides. Even though the four honey extracts had different antioxidant activity, reflecting the different polyphenol content and profile, they showed comparable effect on cell genotoxicity induced by pesticide exposure.”



Chlorella Detoxes HCAs

- Chlorella supplement for 2 weeks to 6 women
- Reduced levels of certain heterocyclic amine metabolites





How Can I Use Nutrition to Support Patients Exposed to Plastics?



Going Plastic-Free Leads to Quick Drops in Body Plasticizers

- An organic, fresh (no cans or plastic) food diet dropped BPA levels by 66% and phthalate (DEHP) metabolites by 53-56% within 3 days



Don't Drink Out of Cans

- N= 60
- 3 study site visits:
 - 2 glass bottles
 - 2 cans
 - 1 glass bottle, 1 can
- Urinary BPA concentration, blood pressure, and HRV was measured 2 hours after the consumption of each beverage
- The urinary BPA concentration increased after consuming canned beverages by >1600% compared with that after consuming glass bottled beverages
- SBP increased by ≈ 4.5 mm Hg after consuming 2 canned beverages compared with that after consuming 2 glass bottled beverages, and the difference was statistically significant



Where to Start with a Basic Nutrition Protocol for Most Patients?



Basic Clinical Steps for Detox

- | | |
|-------------|---|
| IDENTIFY | 1. Identify and remove the source of contamination |
| PROTECT | 2. Protect against toxicant damage |
| ELIMINATE | 3. Support proper elimination routes
(gut, kidneys, skin, lungs) |
| SUPPORT | 4. Enhance liver detox pathways |
| RE-EVALUATE | 5. Re-evaluate symptoms and labs |



What Is the Difference between Detox and an Elimination Diet?

- Start with food first
- Remove the offending toxic agents through an elimination diet
- Add in nourishing foods to assist the detox pathways





Remove From Diet

- Processed foods
- Highly refined sugars and fats
- Energy drinks, soft drinks, reduce caffeinated drinks
- Overly cooked, browned or fried foods
- Plastic and cans
- Potential allergens and intolerances

- High quality protein throughout the day
- Colorful phytonutrients
 - eat the rainbow
- Cruciferous vegetables
- Spices



Detox Eating According to the Body Rhythms

- Smoothie
- Raw lunch
- Cooked dinner





Food Preparation Guidelines

- You can make a food toxic through cooking
- Use proper cookware
- Slow, low, and moist methods of cooking preferred to dry heat methods
- Combination of raw and lightly steamed
- Use water instead of oil
- Fermentation



Watch For Scuffed Pans



Avoid Plastic in All Forms

“Diisobutyl phthalate and dibutyl phthalate were found in the samples of spices and roasted chicken meat. The highest concentrations of plasticisers were found in the spices used to cook the chicken meat.”





Food or beverage

- Allium vegetables
- Apiaceous vegetables
- Black raspberry
- Black tea
- Blueberry
- Chamomile tea
- Chicory root
- Citrus
- Coffee
- Cruciferous vegetables
- Dandelion tea
- Garlic
- Ghee
- Ginger
- Grapefruit
- Green tea
- Honeybush tea
- Peppermint tea
- Pomegranate
- Purple sweet potato
- Rooibos tea
- Rosemary
- Soybean/black soybean
- Turmeric

Nutrient Bioactives

- Astaxanthin
- Caffeic acid
- Catechins
- Chrysin
- Curcumin
- Daidzein
- Ellagic acid
- Ferulic acid
- Fish oil
- Genistein
- Luteolin
- Lycopene
- MCTs
- Myricetin
- N-Acetylcysteine
- Naringenin
- Resveratrol
- Retinoic acid

Top Plant Foods for Detox and Their Bioactives



WHOLE DETOX™

WHOLE DETOX RAINBOW FOOD TRACKER

INSTRUCTIONS: Each day during Whole Detox, try to eat the full spectrum of colors in your meals. To track your colors, check the box to indicate that you've eaten a certain color that day. Use the notes section to track specific foods, how they made you feel, or your thoughts about this colorful experience!

DAY	RED	ORANGE	YELLOW	GREEN	AQUAMARINE	BLUE/PURPLE	WHITE	NOTES
1								
2								
3								
4								
5								
6								
7								
8								
9								
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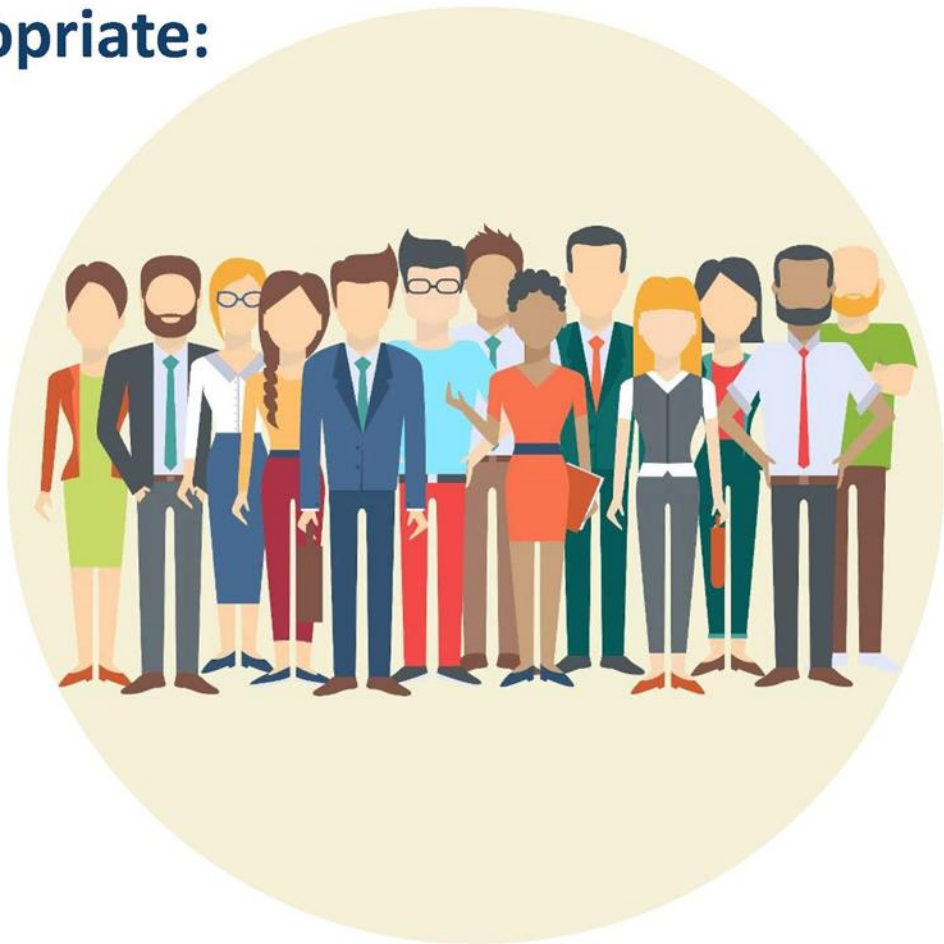
For More Complex Patients, Consider Supplementation

What about Supplements in the Absence of Dietary Change?



When It's Patient-Appropriate:

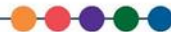
- Patients who are not dietary compliant
- Need demonstrated relief of symptoms





Toxins in Natural Health Products and Pharmaceutical Preparations

“Toxic element contamination was found in many supplements and pharmaceuticals...Some NHPs demonstrated contamination levels above preferred daily endpoints for mercury, cadmium, lead, arsenic or aluminum. NHPs manufactured in China generally had higher levels of mercury and aluminum.”



Case Study

Dietary Supplement Powder Intervention

- 68 yo Caucasian male, urban dweller
- HTN, arrhythmia, amalgams
- No dietary change
- 54% reduction in MDQ after 1 week introduction of dietary supplement powder
- Reported some sinus congestion, frequent urination
- 4.4# weight loss at Day 14
- BP steady, no change
- Two amalgams loosened while taking product



What I Have Found Detoxes to Do for Patients

- Remove the cloud of brain fog
- Get rid of pain
- Heal the gut
- Help them figure out which foods they should be eating
- Stop making them sick all the time
- Give them energy
- Clear up their skin
- Help them reduce their medications
- Help them regulate their emotions
- Reduce stress
- Help them reduce inflammation
- Help them recover from illnesses



*One simple change is
full of great, big, huge
potential.*

— Deanna Minich



Diet and Leaky Gut



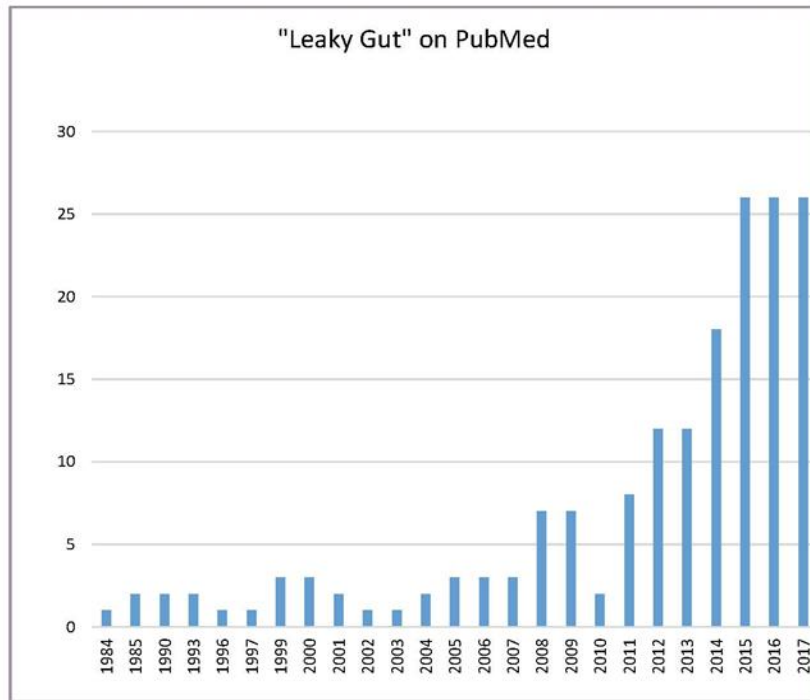
LEAKY GUT

Intestinal Permeability



Is “Leaky Gut” a Legitimate Term?

- “From an MD’s standpoint, it’s a very gray area,” says gastroenterologist Donald Kirby, MD, director of the Center for Human Nutrition at the Cleveland Clinic. “Physicians don’t know enough about the gut, which is our biggest immune system organ.”
- “Leaky gut syndrome” isn’t a diagnosis taught in medical school. Instead, “leaky gut really means you’ve got a diagnosis that still needs to be made,” Kirby says. “You hope that your doctor is a good-enough Sherlock Holmes, but sometimes it is very hard to make a diagnosis.”
- “We don’t know a lot but we know that it exists,” says Linda A. Lee, MD, a gastroenterologist and director of the Johns Hopkins Integrative Medicine and Digestive Center. “In the absence of evidence, we don’t know what it means or what therapies can directly address it.” - WebMD



"Leaky gut" - More Commonly Used



Leaky Gut As a Danger Signal for Autoimmune Diseases

Olivier Muir¹, Jay Kirby², Christopher M. Kelly³ and Xin Li^{1*}

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The intestinal epithelial lining, together with factors secreted from it, forms a barrier that separates the host from the environment. In pathologic conditions, the permeability of the epithelial lining may be compromised allowing the passage of toxins, antigens, and bacteria into the lumen to enter the blood stream creating a "leaky gut." In individuals with a genetic predisposition, a leaky gut may allow environmental factors to enter the body and trigger the initiation and development of autoimmune diseases. Genetic evidence shows that the gut microbiota is important in supporting the epithelial barrier and therefore plays a key role in the regulation of environmental factors that enter the body. Several recent reports have shown that probiotics can reverse the leaky gut by enhancing the production of tight junction proteins; however, additional and longer term studies are still required. Conversely, pathogenic bacteria that can breach a leaky gut and induce autoimmune symptoms can be ameliorated with the use of antibiotic treatment. Therefore, it is hypothesized that modulating the gut microbiota can serve as a potential method for regulating intestinal permeability and may help to alter the course of autoimmune diseases in susceptible individuals.

Keywords: leaky gut, intestinal permeability, gut microbiota, probiotics, autoimmunity

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Elevated fecal calprotectin in patients with Alzheimer's dementia indicates leaky gut

Friedrich Leblhuber¹, Simon Geisler²,
Kostja Steiner¹, Dietmar Fuchs¹, Burkhard Schütz¹

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Abstract Fecal concentrations of calprotectin were examined in 22 patients with Alzheimer's disease (AD) and compared with serum concentrations of aromatic amino acids. Calprotectin concentrations were mean $\pm$ SEM 140 ± 31.9 mg/kg. 16 patients (73 %) presented with concentrations outside normal (>50 mg/kg). Concentrations correlated inversely with serum levels of tryptophan, tyrosine and phenylalanine (all $p < 0.05$). Increased concentrations of fecal calprotectin indicate a disturbed intestinal barrier function in AD patients which could be of relevance for the lowering of essential aromatic amino acids concentrations in the blood.

Keywords Alzheimer disease · Calprotectin · Leaky gut · Phenylalanine · Tryptophan · Tyrosine

Introduction

Neuroinflammation and oxidative imbalance are among the earliest events in Alzheimer's disease (AD) (Clark et al. 2010; Chang et al. 2012). Cerebral amyloid, one of the key hallmarks of AD pathology, was shown to be increased in various inflammatory conditions: in the respiratory tract, in

rheumatoid arthritis and in chronic inflammatory bowel disease, the latter is also going along with elevated calprotectin levels in serum (Mc Manus et al. 2014; Debrai et al. 2014). Calprotectin is a protein released by leukocytes into inflamed tissues. It provides not only bacteriostatic but also cytokine-like effects in the local environment and can be used as inflammatory marker (Sitrin and Treibschavsky 2006). Recent studies found that calprotectin triggers and promotes the formation and aggregation of β -amyloid in vitro as well as in animals (Zhang et al. 2012; Kim et al. 2014). To investigate a potential role of calprotectin in AD, fecal calprotectin was determined in patients.

Patients and methods

The study was approved by the local ethics committee, and 22 patients with AD (19 females, 3 males, aged 79.5 ± 8.9 years) were included. Diagnosis of AD was established by magnet resonance tomography (MRT) and positron emission tomography (PET) scans. Routine laboratory tests including electrolytes, blood cell count, hemoglobin, hematocrit, platelets, serum enzymes, urine analysis, blood glucose, HbA1c, bilirubin, bicarbonate, creatinine, blood urea nitrogen, C-reactive protein, total serum protein, folic acid, vitamin B₁₂, vitamin D, homocysteine and thyroid parameters were measured in all of our patients to exclude treatable factors underlying the dementing process. Mini Mental State Examination (MMSE) and Clock Drawing Test (CDT) scores were examined.

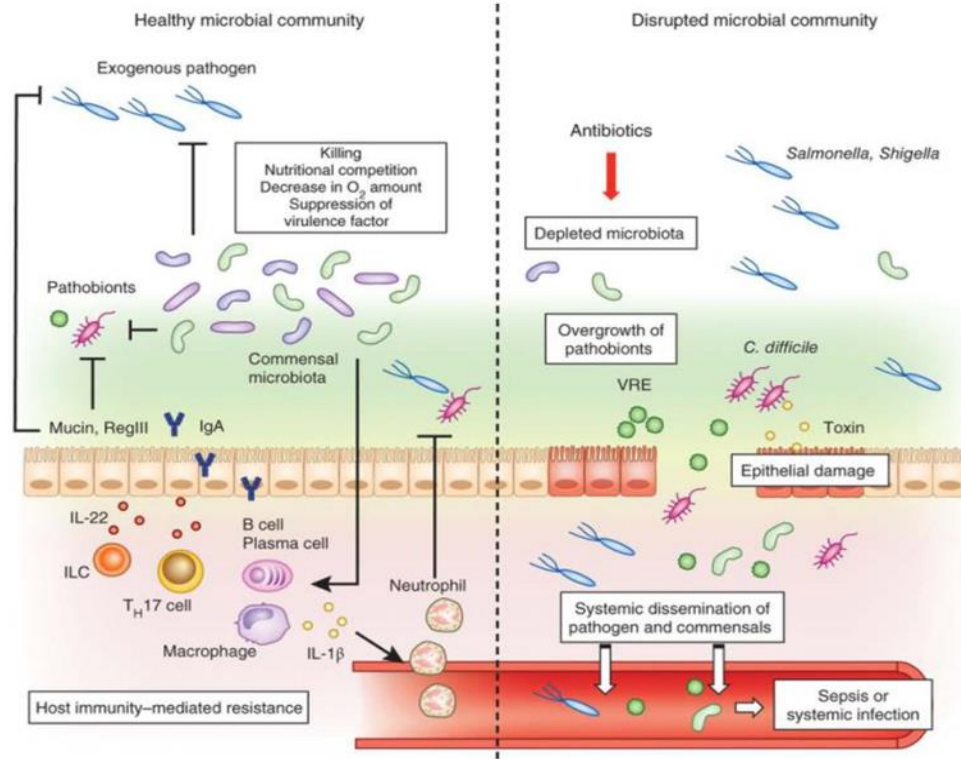
Calprotectin was measured in 2 g fecal samples, stored at -20°C (Bioviv Diagnostik MVZ, Limburg an der Lahn-Offheim, Germany). Additionally, the following laboratory

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Leaky Gut: An Extreme View



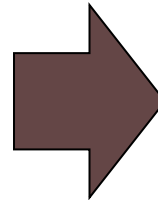
Gut Ecosystem



Good microorganisms

Balance

Bad microorganisms



Good digestion

Energy
Production

detoxification

produce important
biological chemicals like
serotonin and dopamine
(needed for brain
function).

Role of Probiotic Supplementation

- Support the growth of beneficial intestinal flora while helping to crowd out the undesirable bacteria - Keep good flora in Balance
- There are many types of probiotic supplement available- if the offending pathogenic bacterium has been identified through laboratory testing, a single strain product specifically effective for that bacterium might be utilized. If the bacteria have not been identified, then multi-strain product would probably be used.

Commonly Used Probiotic strains

Lactobacillus acidophilus

- Inhibition of multiplication and colonization of undesirable flora
- Aids in the digestion and absorption of nutrients
- Help alleviate lactose intolerance by producing lactase enzyme
- Produce a broad range of natural antimicrobial substances which help resist diseases production microorganism

Lactobacillus rhamnosus

- Crowd out undesirable flora
- Support the mucosal immune response to potentially harmful invading bacteria

Lactobacillus GG (LGG)

- Prevent the overgrowth of harmful bacteria in the intestine
- Helping control *Clostridium difficile*

Lactobacillus plantarum (L.plantarum)

- Eradicate pathogens such as *Clostridium*

Lactobacillus Casei (L.casei)

- Mucosal immune response
- Secrete peptido-glycan which stimulated phagocytosis by macrophages - another important immune response

Bifidobacterium bifidum (B.bifidum)

- Preventing colonization of invading undesirable flora and yeast (*Candida albicans*)
- Producing acetic and lactic acids which lower the pH
- Support mucosal immunity

Bifidobacterium lactis (B. lactis)

- Crowd out undesirable flora
- Support the mucosal immune response to potentially harmful invading bacteria
- Helping to control diarrhea in infants

Bifidobacterium breve (B. breve)

- Effective in colonizing the immature bowels of infants resulting fewer abnormal sign and better weight
- Positive effect on immune response

Streptococcus thermophilus (S. thermophilus)

- Enhanced dairy digestion by producing enzyme lactase
- This strain is unrelated to streptococcus organisms that cause infection and diseases

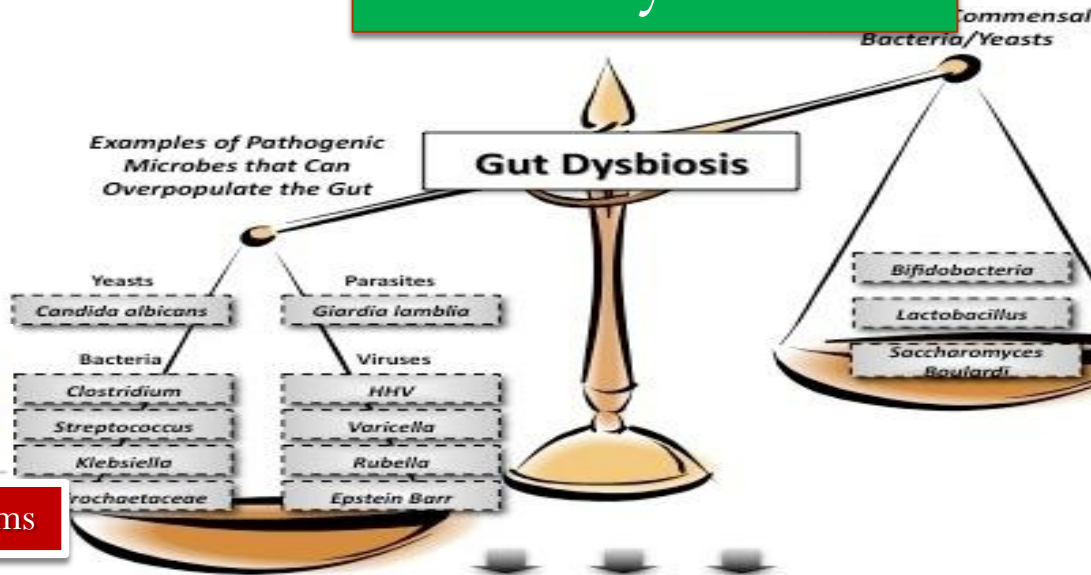
Saccharomyces boulardii (S. boulardii)

- Ability to control certain pathogenic bacteria, especially *Clostridium difficile*.

Gut Dysbiosis



Bad microorganisms



Some Consequences of Gut Dysbiosis

- Localized gut inflammation
- Systemic inflammation
- Increased oxidative stress
- Increased production of endotoxins and other biotoxins
- Altered production/synthesis of neurotransmitters
- Intestinal permeability
- Chronic infections
- Impaired detoxification/regulation of oxidative stress (e.g., sulfation)
- Impaired energy metabolism
- Impaired nutrient synthesis (e.g., vitamins, minerals and short-chain fatty acids)
- Impaired enzyme activity
- Autoimmunity



Diet Induced Leaky Gut

- Foods have undergone considerable transformation
 - New strains of grain: wheat, rice, soy, corn
 - More genetically modified crops than the rest of the world combined
- Chemical use: pesticides, fungicides, insecticides
- Dairy cows injected with hormones – into milk products
- Chemical ingredients in our foods: artificial preservatives, colorings, and flavorings
- Heavy metals, such as arsenic in CAFO's: include cattle, hogs, turkey, and chicken



Diet Induced Leaky Gut

- **Pesticides** bind to protein in foods altering so immune system attacks
- **Artificial sweeteners** – especially in soft drinks
- **High processed salt consumption** – leading to cardiovascular disorders and contributing to immune reactions
- Abundant use of **plasticizers such as bisphenol A** in food and beverage containers contributes to this overreaching environmental exposure to xenobiotics as well
- Widespread use of **antibiotics, antacids, proton pump inhibitors, histamine 2 blockers, and other drugs**, many of which are available over the counter, adds to what we consume

Leaky Gut and Disease Risk Association

- Acne
- Allergies & Asthma
- Autoimmune Disease
 - Diabetes
 - Reactive arthritis
 - Rheumatoid arthritis
 - Ankylosing spondylitis)
- Autism



Leaky Gut and Disease Risk Association

- Colorectal cancer
- Cardiovascular Disease
- Irritable bowel syndrome
- Inflammatory Bowel Disease
- Fatty Liver Disease
- Obesity
- Aging



Sign That You Have A Leaky Gut



Increased food allergies

Unfortunately, food allergies and leaky gut syndrome seem to create a vicious cycle, as one affects the other. As undigested food particles pass through the intestine, these allergies get worse, then these allergic reactions increase permeability even further. Meaning, this syndrome can actually make you allergic to foods that you would normally digest.



I may have leaky gut syndrome,
what now?





Preventing and Treating Intestinal Permeability

- Since intestinal permeability is rarely a “stand-alone” diagnostic criteria, there are few studies that investigate this as a primary outcome
- Many studies looking at in-vitro changes in barrier function (Ussing Chamber) and animal studies looking for influences of nutrients
- Few human clinical trials so far



Dietary Interventions

- It is assumed that common dietary patterns that induce poor microbiome balance, inflammation and chronic disease (excessive fat, refined carbohydrates, phytonutrient poor) are linked with increased intestinal permeability
- Few studies using dietary interventions have looked at changes in gut permeability



The 5 R Program

1. REMOVE
2. REPLACE
3. REINOCULATE
4. REPAIR
5. REBALANCE



Therapeutic Summary

- Discover and avoid foods known to cause increased intestinal permeability
 - May include: gluten, dairy/lactose, capsicum/spicy foods, FODMAPs, etc.
 - Test for (and avoid) food allergens (IgE/mast cell stimulation)
- Cease NSAID use if possible
- Assess HPA axis stressors and treat accordingly - stress directly influences gut permeability
- Avoid strenuous physical activity/exercise or pay special attention to supporting gut and immune health before and after such activities - moderate exercise is helpful
- Avoid processed foods with artificial colors and flavors
- Eat abundant amounts of fresh fruits and vegetables to maximize the amount and diversity of phytonutrients



Therapeutic Summary Cont.

- Consider the following nutrients for supplementation:
 - Omega-3 fatty acids, ALA, EPA, DHA (through diet and supplementation)
 - Glutamine (4 to 8 grams daily)
 - Vitamin D (1,000 IU minimum daily; best to test and dose to desired serum levels)
 - Probiotics (mixed strain combination 20-40 billion CFU; consider high doses for long-standing intestinal barrier issues or when associated with IBD)
 - Prebiotics (precursor for important short-chain fatty acids - may be contraindicated if FODMAPs are to be avoided)
 - Zinc (25 mg daily with other minerals)
 - Iron (only when iron deficiency is confirmed)
 - Flavonoids (for quercetin and related compounds, dose not as important as consistent daily consumption from foods and supplementation)
 - Colostrum/Lactoferrin/IgG
 - Berberine (consider adding 1 g/day when subject is obese, insulin-resistant or has type 2 diabetes)

THANK YOU

